Neither Rain Nor Sleet Will Stop NASA's Ares Rockets

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Kevin McGrath, left, a terrestrial environments engineer at the Marshall Center, and Barry Roberts, a Marshall rocket scientist, check weather station equipment. Credit: NASA/MSFC

Barry Roberts wants to help build a better rocket…one that can fly despite record low temperatures, one that hail and rain can't stop.

Roberts is a rocket scientist, but he's not your typical rocket man. He leads a team of scientists that study terrestrial and planetary environments. That's everything from winds here on Earth to planetary atmospheres, meteoroids, orbital debris and even how a spacecraft can build a charge in space.

Roberts is part of the Engineering Directorate's Natural Environments Branch at the Marshall Space Flight Center. And, as you can see, he is

not your typical weatherman either, though that was once his dream.

He remembers himself as an inquisitive 7-year-old who often carried a logbook to keep notes about weather conditions and weather reports. Roberts also recalls trips with his father to North Alabama television stations to meet local on-air weather personalities in the 1970s and '80s like H.D. Bagley and Bob Barron. Bagley helped him become a member of the American Meteorological Society when he was only 15 years old.

"I've always been a weather nut as far back as I can remember," Roberts said. “I've always liked science and thought working at NASA would allow me to work in a field I enjoyed and allow me to achieve my dreams."

He received his bachelor's degree in physics from the University of North Alabama in Florence in 1986. During this time he also worked two summers at the Marshall Center as an intern in the Earth Sciences Branch, where one of his jobs included launching weather balloons.

This experience reinforced his desire to work for either NASA or the National Weather Service. In 1989, he received a master's degree in mechanical engineering from the University of Alabama in Huntsville. "My first job here at NASA was in 1989 working on Space Station Freedom in the Environmental Control and Life Support Branch," Roberts explains. "I worked on the air conditioning, or environmental control, for the International Space Station."

In 1997 he transferred to the Electromagnetics and Aerospace Environments Branch, a predecessor to the Natural Environments Branch. Shortly afterward he went back to school and received a master’s degree in atmospheric science from the University of Alabama in Huntsville in 2005.

More than a weather forecaster

Today, as lead for the terrestrial and planetary environments team, Roberts leads 14 team members.

"When most people think of weather, they are really thinking about forecasting, but we don't do forecasting here," Roberts said. "We try to characterize the Earth's atmosphere and its surface or the terrestrial environment that an aerospace vehicle will be exposed to during its operational lifetime. The vehicle will be exposed to weather conditions while it is sitting on the launch pad, and must fly through the atmosphere to get to space and return back to Earth."

For each of these conditions, the team describes and envelopes the naturally occurring terrestrial environment for the design engineers, and then the team works with them to define launch vehicle constraints, or the range of environmental conditions the vehicle can be built to withstand.

"We look at various aspects such as temperature," Roberts said. "For example, temperature records at the Kennedy Space Center in Florida indicate the temperatures range from a low of 19 degrees Fahrenheit to a maximum of 100 degrees Fahrenheit. NASA engineers will want to design components exposed to the outside air to withstand this temperature range while the vehicle is on the launch pad."

Developing a road map for Ares

When Ares Projects first started almost three years ago, the terrestrial and planetary environments team was on board. "One of our first jobs was to help create a document called the Constellation Program Design Specification for Natural Environments," Roberts said. "We started with

the space shuttle requirements, which are often difficult to interpret, and tried to develop definitions of the terrestrial environment that would be easy for the engineering community to use and understand."

The design specification document is a one-stop shop for all natural environments and assists engineers in all phases of development of the Ares rockets that will take crews to the International Space Station – then to the moon and beyond.

The terrestrial and planetary environments team negotiates with design engineers and program and project mangers to determine which environments the vehicle can be designed to withstand. The environments that the vehicle cannot be designed to withstand, usually due to cost or technology constraints, are dealt with in terms of operations constraints or are accepted as risks.

"The shuttle is able to launch 80-90 percent of the time. Engineers hope to achieve a 95 percent launch capability with the new Ares rockets," Roberts said.

Managers are optimistic that rain and hail damage may not be an issue for the Ares upper stage thermal protection foam. "Engineers are doing analyses to determine the cost of designing a vehicle that can withstand various sizes of hail," Roberts said. "Then they will weigh the increased cost to beef up the vehicle compared to the possibility of taking a launch delay at some point in the future."

Building a strong team

Roberts is proud of his team and their many accomplishments. "It stands to reason that the more we can learn about an environment, the better we can model and define it, and help the engineering community design more robust vehicles," Roberts said.

"We are always striving to improve terrestrial environment models and add better information to our ever growing databases, not just for the launch facilities at Kennedy Space Center, but for other locations around the world," Roberts said. "By keeping up with the most current technology in areas such as atmospheric measurement systems, it allows us to help engineers edge closer to the golden icon we are going after: building the perfect spacecraft."

The Natural Environments Branch at Marshall is unique within all of NASA. Not only does it support engineers at Marshall, it also supports many other customers including Johnson Space Center; Kennedy Space Center; NASA's Ames Research Center at Moffett Field in Calif.; White Sands Missile Range in Las Cruces, N.M.; and NASA's Jet Propulsion Laboratory in Pasadena, Calif.

The group is also an associate member of the Range Commanders Meteorology Group whose members are from other NASA centers, several National Oceanic and Atmospheric Administration centers, and the Army, Air Force, Navy and Marine ranges. These groups work to gather up-to-date environmental information for use with a broad range of NASA and military programs.

Roberts has a high level of enthusiasm for his current role as leader of the environments team. "I have the best job in the world and feel that the work we do here is vital to the success of NASA and the development of new launch systems," Roberts said.

Source: NASA